Patentclaims

1. A telecommunication or data communication node comprising a number of plug-in units, a first number of the plug-in units is hosting a device processor, the first number of the plug-in units comprises two flash memory banks,
characterised in that a traffic and a control system are separated within said node and/or each of said plug-in units have separate traffic and control system.

2. System according to claim 1,
characterised in that said traffic system within said node and/or said plug-in units have a redundant architecture, and redundancy within the power system is optional.

3. System according to claim 1,
characterised in that the traffic system have redundant traffic buses, the Time Division Multiplex, TDM, buses have redundant switching functions, the Plesi-synchronous Digital Hierarchy, PDH, and Synchronous Digital Hierarchy, SDH, synchronisation buses are redundant and the fan systems are redundant.

4. System according to claim 1,
characterised in that said node's software consists of the following major component types:

a. basic node software, BNS, that realises the control and management of said node and its Traffic Node Basic Node Hardware Building Blocks, TN BNH BB, residing on Application Plug-in Units, APU's,

b. application node processor software, ANS, which is a control software for the application and for all software on a Node Processor Unit, NPU,

c. application device processor software is located on the APU, provided that the APU houses one or more processors, it interfaces with ANS.

5. System according to any of the previous claims, characterised in that said node's hardware architecture consists of Basic Node Hardware, BNH, in which Application Plug-in Units can be placed.

6 System according to any of the previous claims, characterised in that said BNH provides communication buses being a part of a backplane and a power distribution bus between Plug-in Units.

7. System according to claim 6, characterised in that said communication buses are of one or more of the following types:

a. Serial Peripheral Interface, SPI, a low speed synchronous serial interface used for equipment handling and control of:

APU cold and warm resets,

status LEDs and block received signals, BRS,

inventory data such as product number serial number and asset identifier,

temperature supervision,

power supervision,

board position interconnect, BPI, disable and enable,

peripheral component interconnect, PCI, fault handling,

b. PCI bus, a multiplexed address/data bus for high bandwidth applications used as the main control and management bus in said node, hence being a part of the control system

c. TDM bus, implements the cross connect functionality in said node it is a part of the traffic system,

d. power distribution,

e. synchronisation buses such as PDH and SDH buses being a part of the traffic system,

f. BPI buses for application specific inter APU communication,

g. Point to point, PtP bus for central switching of high capacity traffic,

h. programming bus intended as Joint Test Action Group, JTAG, bus for programming of field programmable gate array, FPGAs, in said node.

8. System according to any of the previous claims, characterised in that management of said node is performed over data communication network using in band capacity on transport links.

9 System according to claim 8, c h a r a c t e r i s e d i n that said data communication network is an IPv4 based network.

10 System according to claim 9, c h a r a c t e r i s e d i n that Open Shortest Path First, OSPF, is used as routing protocol for said data communication network.

11. System according to any of the claims 8-10, c h a r a c t e r i s e d i n that said node communicates with the following services:

a. Dynamic Host Configuration Protocol, DHCP, for assignment of IP addresses to equipment on the site-LAN, e.g. an embedded element manager, EEM,

b. Network Time Protocol, NTP, for accurate time keeping

c. up and download for software upgrade and configuration using File Transfer Protocol, FTP,

d. the Network Element Manager, NEM, uses Simple Network Management Protocol, SNMP, for monitoring and configuring said node,

e. .the EEM is a computer that communicates HTML pages containing JavaScript over Hyper-Text Transfer Protocol, HTTP, with the Embedded Element Manager (EEM) in said node by means of a web browser.

12. System according to any of the previous claims, c h a r a c t e r i s e d i n that the management of

said node is further performed by one or more of the following devices:

a. a computer with a web browser that connects with an embedded element manager and/or

b. remotely by a traffic node manager using a combination of both embedded element manager and SNMP interface and/or

c. remotely by an operator specific Operations Support System or network management system

13. System according to any of the previous claims, c h a r a c t e r i s e d i n that said node comprises 1 to 20 application plug in units, APU.

14. System according to claim 13, c h a r a c t e r i s e d i n that every said APU in said node is handled by one application.

15 System according to any of the previous claims, c h a r a c t e r i s e d i n that said node is operating in a PDH/SDH microwave transport network.

16 System according to claim 15, c h a r a c t e r i s e d i n that said traffic system interfaces between a one or more TDM bus(es) and a E1 input through four principal blocks:

- a redundant traffic basic node,
- a line protection block,

- an equipment protection block and

- a crossconnect block.

17 System according to claim 16, characterised in that data from said traffic basic node is divided into two identical data streams a first data stream and a second data stream, both streams is forwarded to a respectively first and second line protection sub block, each being symmetrical sub blocks, the first sub block handling the first data stream, the second sub block handling the second data stream, the first and the second sub block each comprises a first and a second traffic application plug in unit and a control application plug in unit.

18 System according to claim 16 and 17, characterised in that said first and second data stream are forwarded to said equipment protection block, said equipment protection block is formed by a first and a second sub block and a common block, the first and the second sub block each comprises a traffic application plug in unit, a mux and a port, the common block comprises at least one control application plug-in unit and a node processor unit in reciprocal action with the first and the second sub block of the equipment protection block

19 System according to claim 16 to 18, characterised in that said first and second data stream are forwarded to a respectively first and second cross connect sub block the first sub block comprising two cross connect application plug-in units denoted with a first number and a control block consisting

of a node processor unit and a peripheral component interface denoted with the first number, the second sub block comprising two cross connect application plug-in units denoted with a second number different from the first number and a control block consisting of a node processor unit and a peripheral component interface denoted with the second number, said first and second data streams after being processed in said cross connect block are further forwarded to said one or more TDM bus(es).

and a the control beach being symmetrical in a hardware sub blocks the first sub block handling the first data stream, the second sub block handling the second data stream, the first and the second sub block each comprising a first and a second cross connect application plug in units and a control application plug in unit.

20 System according to claim 1,
c h a r a c t e r i s e d i n that a temperature measurement are executed by temperature sensors in the serial peripheral interface building blocks.

21 System according to claim 20,
c h a r a c t e r i s e d i n that the temperature sensors will measure the temperature on all boards in said node and two levels of temperature alarms are supported:

- a first alarm, temperature high temperature, and
- a second alarm temperature excessive temperature.

22 System according to claim 1,
c h a r a c t e r i s e d i n that said node have a

plurality of distributed power sensors sensing a voltage level on said boards.

23 A method for non interrupting installation, operation, maintenance, supervising, hardware or software upgrading a telecom or data communication node where the node comprises a plurality of plug-in units a one or more backplane buses, a first number of the plug-in units is hosting a device processor, the first number of the plug-in units comprises two flash memory banks,
c h a r a c t e r i s e d i n that hot swapping/removing/replacing a plug-in unit comprises the step of:

a. pushing or pulling a first switch indicating a plug-in unit removal,

b. wait for a first signal indicating an activation of the first switch,

c. when the first signal becomes active, the first signal denotes a start of a board removal interval time, τ_2, and

d. the plug-in unit can be removed during the board removal interval.

24 A method according to claim 23,
c h a r a c t e r i s e d i n that replacing said plug-in unit includes the step of removing said plug-in unit during the board removal interval τ_2 and within a second interval, a board replacement interval τ_6, adding a new plug-in unit to said node.

25 A method according to claim 23, characterised in that if the board removal interval time, τ_2, expires without removal of a plug-in unit and the plug-in unit is an application plug-in unit, the plug-in unit will be taken into service and perform an application plug-in warm restart.

26 A method according to claim 23, characterised in that removing a plug-in unit comprising a node processor during the board removal interval τ_2 comprises the steps of:

a. the plug in unit comprising the node processor is set in a passive equivalent state,

b. the plug in unit comprising the node processor is executing a peripheral component interconnect reset

27 A method according to claim 26, characterised in that if the board removal interval τ_2 expires without removal of the plug-in unit, the plug-in unit will perform a node processor cold restart.

28 A method according to claim 23, characterised in that a basic node software and an application node software interacts according to the following steps during removal/replacement/swapping of plug-in units:

a. pushing or pulling the first switch indicating a board removal causes the basic node software to inform the application node software that a plug-in unit shall be taken out of service,

b. the application node software executes a number of commands as a response to the information given from the basic node software,

c. thereafter, when the application node software has finished the number of commands it will report to the basic node software that the plug-in unit can be removed,

d. then the basic node software is deallocating a peripheral component interconnect device drivers for the plug-in unit and indicates the deallocation with a visible signal, such as turning on a LED,

e. the basic node software places the application plug-in unit in cold reset

29 A method according to claim 23, characterised in measuring a temperature on all boards within said node and supporting two levels of temperature alarms.

- a first alarm temperature high temperature, and
- a second alarm temperature excessive temperature.

30 A method according to claim 29, characterised in that the two levels of temperature alarms are:

a. a first alarm temperature; high temperature, and

b. a second alarm temperature; excessive temperature.

31 A method according to claim 29, characterised in that measuring temperatures are executed by temperature sensors in a serial peripheral interface building blocks.

32 A method according to claim 30 or claim 31, characterised in setting an operational status of a severity level of the temperature alarm on the plug-in units to a following levels according to crossed temperature thresholds:

a. severity is set to minor if the temperature is above the high temperature threshold and below the excessive temperature threshold, or

b. severity is set to critical if the temperature is above the excessive temperature threshold.

33 A method according to claim 30 or claim 31, characterised in that operation of the node or plug-in units for temperatures following a temperature curve measured by said sensors, ranging from a normal temperature interval to an excessive temperature interval and back to the normal temperature interval comprises the steps of:

a. the temperature is below the high temperature threshold, that is within the normal temperature interval, the node or plug-in units are in normal operation,

b. the temperature is in the high temperature interval, rising from the normal temperature interval, control functions are automatically switched off, the traffic functions are unaltered, alarm is sent to a OAM system,

c. the temperature is in the excessive area interval rising from the high temperature interval, an automatic hardware shutdown of both control and traffic related hardware and an alarm is sent to the OAM, this situation equals a cold reset,

d. the temperature is in the high temperature interval, falling from the excessive temperature interval, said node is restarted without control functions running, status is sent to a control and management system, and

e. the temperature is in the normal temperature interval falling from the high temperature interval said node and/or plug-in unit is returning to normal operation.

34 A method according to claim 33, characterised in that step b further comprises the step of setting application plug-in units to power save modus equalling setting the plug-in unit to a warm reset.

35 A method according to claim 33, characterised in that return to normal operation in step e is restricted to incidents where the temperature is below the high temperature threshold for a period longer than said board removal interval τ_2.

36 A method according to claim 23, characterised in that supervision of one or more cooling fans is performed by monitoring fan status that is signalled on a serial peripheral interface bus from a power filter unit.

37 A method according to claim 36, characterised in that individual fans are supervised and a failure is indicated if one fan fails.

38 A method according to claim 23, characterised in that said node is monitoring correct local power on one or more application plug-in units.

39 A method according to claim 38, characterised in that power failure will be indicated by a visual signal such as turning off a power LED or lamp.

40 A method according to claim 38 and 39, characterised in that the power failure further comprises the step of setting said application plug-in units in an operational state indicating the power failure, such as critical/hardware error.

41 A method according to claim 40, characterised in that said error will be reported to an application and thereafter to an embedded element manager.

42 A method according to any of the claims 38 to 39, characterised in that the plug-in unit is in cold reset until the power failure is terminated.

43 A method according to claim 23, c h a r a c t e r i s e d i n that the first and second memory bank are placed in a passive and an active state/modus respectively and the states/modes are interchangeable between the first and second memory bank.

43 A method according to claim 23, c h a r a c t e r i s e d i n that software upgrading the node from a first version n to a second version n+1 comprises the following steps:

a. the second version n+1 is downloaded to a passive memory bank, and

b. a pointer is written to the passive memory bank making the passive memory bank the active one and consequently the previous active memory bank is made the passive memory bank.

44 A method according to claim 43, c h a r a c t e r i s e d i n that step a further comprises the step of executing a test-run on the second version n+1.

45 A method according to claim 23, c h a r a c t e r i s e d i n that a software system release is configured with three software modules

a. traffic node basic node software in a node processor software load module,

b. application node software in a node processor software load module, and

c. application device software , such as application plug-in units with device processor.

46 A method according to claim 45, c h a r a c t e r i s e d i n that software upgrading of said node is always from one system software release, n, including all of the modules to another system software release n+1, including all of the modules.

47 A method according to claim 46, c h a r a c t e r i s e d i n for keeping a current system software release backward compatible to system software releases preceding the current software release with at least two releases.

48 A method according to claim 23, c h a r a c t e r i s e d i n that installation of said node comprises at least the following major steps:

a. equipping an application module magazine with a number of plug-in units among others at least one is a node processor unit,

b. turn on the power for said node,

c. press a board removal switch,

d. check configuration of the node processor unit, if configuration is present one may delete the configuration and replace it with factory settings, if configuration is replaced a software upgrade have to be performed,

e. check if radio link configuration is necessary, if necessary then radio link frequencies have to be configured and/or antenna alignment have to be configured

f. manual or automatic security and software upgrade set up is executed,

g. exit the installation modus, and

h. said node will perform a save of the configuration and enter normal operation.

49 A method according to claim 48, characterised in that the manual set up comprises the following actions

a. if a software upgrade is necessary a manual upgrade will be initiated, and the upgrade progress will be displayed, and

b. the data communication network and the inventory data will be displayed to an operator.

50 A method according to claim 48, characterised in that the automatic set up comprises the following steps:

a. a configuration file is specified,

b. load configuration file and append,

c. if a software upgrade is necessary an automatic upgrade will be performed, and the upgrade progress will be displayed,

d. the data communication network and the inventory data will be displayed to an operator.

51 A method according to claim 23, characterised in that repairing a first node processor unit comprises the step of:

a. get a configuration file from a remote/central configuration server or from the first node processor unit,

b. remove the first node processor unit,

c. plug-in a new second node processor unit,

d. power up the second node processor unit,

e. push or pull said first switch indicating a plug-in unit removal